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AUTHOR	Brophy, Jere E.
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ABSTRACT

Recent research on teacher planning, thinking, and decision making is reviewed. The work on planning reveals that teachers typically do not use the objectives-based, rational models stressed in textbooks, but instead concentrate on the activities included in a curriculum as they seem to relate to the needs and interests of the students. This indicates the need for training teachers to plan more effectively, and suggests the formation of alternative models of the planning process which might be more appropriate than the rational model. Research on teachers' perceptions, thoughts, and decisions during the teaching process is just beginning, but it suggests exciting possibilities. Work done to date suggests that: most teacher perceptions about students are accurate; most teacher decisions about students are logical and based on appropriate information sources; and teachers' behaviors when interacting with students may be monitored and controlled more consciously than previous work would suggest. (Author/FG)

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TEACHERS' COGNITIVE ACTIVITIES AND OVERT BEHAVIORS

Jere E. Brophy

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Abstract

Recent research on teacher planning, thinking, and decision making is reviewed. The work on planning reveals that teachers typically do not use the objectives-based, rational models stressed in text books, but instead concentrate on the activities included in a curriculum as they seem to relate to the needs and interests of the students. This work indicates the need for training teachers to plan more effectively, and suggests alternative models of the planning process which might be more appropriate than the rational model. Research on teachers' perceptions, thoughts, and decisions during the teaching process is just beginning, but it suggests exciting possibilities. Work done to date suggests that most teacher perceptions about students are accurate, most teacher decisions about students are logical and based on appropriate information sources, and, in general, that teachers' behavior when interacting with students may be monitored and controlled more consciously than previous work would suggest.

TEACHERS' COGNITIVE ACTIVITIES AND OVERT BEHAVIORS[1]

Jere E. Brophy[2,3]

Research on teaching, at least in the United States, largely ignored the mental life of the teacher until the last five years. In Dunkin and Biddle's (1974) review, for example, classroom variables were classified as presage, process, product, or context variables. Little or nothing was said about teacher planning, thinking, or decision making, because very little research attention had been directed to these topics. Dunkin and Biddle lumped what little there was into the presage variable category, along with information on teachers' beliefs, values, and attitudes. Furthermore, most studies that included presage variables concentrated on their relationships with product (outcome) variables. Presage-process relationships usually were investigated only as a sideline, if at all. Finally, the research was virtually silent on the topic of teachers' thoughts while engaged in the act of teaching.

Much of the explanation for this neglect of the mental life of the teacher lies in the pervasive influence of behaviorism on American social science research. Behaviorists look upon thoughts as mere epiphenomena accompanying behavior, perhaps of interest to the agent experiencing the thoughts but not to the behavioral scientist interested in establishing functional relationships and achieving pre-

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[1]This paper is a slightly revised version of a paper prepared for presentation at the meetings of the international research project on Basic Components in the Education of Mathematics Teachers (BACOMET), conducted April 21-25, 1980 at the Kommende Lage in Rieste, Federal Republic of Germany.

[2]Jere E. Brophy is coordinator of the Classroom Strategy Study and a professor of student teaching and professional development, and of counseling and educational psychology.

[3]The author wishes to acknowledge and thank Professor Christopher M. Clark for sharing materials and suggestions about coverage and for providing critical reactions to an earlier draft of the paper, and June Tinney for assisting in manuscript preparation.

diction and control. This position has softened recently even among serious behaviorists, as Bandura (1977), Meichenbaum (1977) and others have stressed the role of thinking (self-talk, verbal behavior, etc.) in directing behavior. Even so, most contemporary American social scientists, including educational researchers, remain more interested in studying teachers' behavior than in studying what is on their minds.

This has generally been true even of investigators who are eclectic in approach and more interested in investigating educational topics in their own right than merely as a means for testing psychological theories. American teacher educators and researchers generally share the notion that teaching is learned much more through imitation and modeling than through reading text books or participating in teacher education courses. Teaching, at least in the early stages, tends to be described not as a rational process, but instead as a frenzied attempt to learn survival skills under conditions of fear and feelings of inadequacy (Fuller, 1969; Doyle, 1977). For a time, esteem for teachers' thinking and decision-making skills sunk so low that attempts to construct teacher-proof curricula became a fad. This has passed, more out of the realization that teacher proofing is not really possible than out of positive respect for the role of teachers in planning and implementing curricula. Complaints about teachers' presumed negative attitudes, lack of subject-matter knowledge, unwillingness to adopt new techniques, and tendencies to subvert the efforts of curriculum developers by omitting or changing instructional methods or parts of the curriculum considered crucial are still very common (especially among math and science curriculum people, in my experience).

Even those more sympathetic to teachers have done little to encourage respect for, let alone investigation of teachers' perceptions, thoughts, or decisions. Jackson (1968), for example, stressed that the complexities of the teaching task are so numerous and varied as to make it difficult, if not impossible, for teachers to monitor their own behavior, let alone remember later what was done or

why. Although Jackson does not say so directly, this emphasis on classroom complexities seems to imply that the teacher's role is necessarily reactive, that it is difficult for teachers to retain and cumulate their experiences so as to become more proactive and systematic in their classroom behavior.

My own writings also have stressed the idea that most teacher behavior is reaction to immediate external stimulation, and until recently my research has concentrated on teachers' behavior rather than on their thinking about what they do or why they do it. This has been the case even though I am coauthor of a text book that stresses good decision making as central to teaching success (Good and Brophy, 1980) and a teacher education book that seeks to make teachers more successful by convincing them of the need to become more proactive and by helping them to develop feedback mechanisms to enable them to learn more from a experiences (Good and Brophy, 1978). My strategy for resolving this seeming contradiction between my belief that teaching is too complex a task to allow for much reflection or proactive decision making, and my belief that better and more systematic decision making is the key to improvement has been to concentrate on developing knowledge about effective teaching and translating it into algorithms that teachers can learn and incorporate into their planning prior to teaching, and on developing ways to help teachers get feedback about their teaching that they can use for review and reflection after they have finished teaching. These algorithms are not necessarily simple nor simpleminded; branching algorithms that allowed for context differences or individual differences in students have been implemented successfully and have led to increased student achievement (Anderson, Evertson, & Brophy, 1979). Even so, it would be fair to say that heretofore my concern about teacher planning has been to provide input to the teacher rather than to study the process naturalistically, and my approach to teachers'

decision making during the act of teaching has been to try to make it more systematic by controlling it through algorithms introduced prior to the teaching act, rather than to try to discover what teachers think about when they are teaching.

I mention this to forewarn readers of my own biases, because they are very different from those of the researchers whose work I will be reviewing in the remainder of this paper. Most of the studies discussed did not approach the mental life of teachers merely as part of a larger attempt to improve teaching practice, although they may have this as an ultimate goal. Instead, these studies stress description and understanding of the mental life of teachers as an activity worthwhile in its own right, along with attempts to capture and model teacher thinking, judgment, and decision making and to tie these to interactive teacher behavior. This is part of a general Zeitgeist in American educational research calling for a reemphasis on description and understanding (the popularity of ethnographic methods is part of the same phenomenon).

More specific impetus for emphasis on teachers' thinking, judgment, and decision making came from Shulman and Elstein's (1975) review chapter of problem solving, judgment, and decision making in medical diagnosis. Shulman and Elstein noted that many of the problems, methods, and theories developed in medical research also applied to educational research, and called for more attention to teachers' thinking. Shulman also brought this emphasis to the National Conference on Studies in Teaching conducted by the National Institute of Education in 1974 in an attempt to develop systematic plans for American educational research in the 1970's and 1980's. The report of Panel 6 of this conference, chaired by Shulman, considered the kinds of research on teaching that could be accomplished when teaching is viewed as clinical information processing and attention is focused on teachers' thinking, judgment, and decision making (National Institute of Education,

Note 1). This led to an interest in these topics among investigators at various American universities, and also to the establishment of the Institute for Research on Teaching at Michigan State University, of which Shulman is the co-director.

The result has been the development of a small but active and growing literature on teachers' thinking. I will not attempt to describe it all at length, because much of it is included in several existing published reviews. In particular, Shavelson (1976) and Borko, Cone, Russo, and Shavelson (1979) have reviewed the literature on teachers' decision making, and Clark and Yinger (Note 2, Note 3) have reviewed the work on teachers' thinking. To facilitate comparison, the present paper will follow the organizational format used by Clark and Yinger (Note 3), summarizing studies covered in that review briefly and discussing subsequent work in somewhat more detail.

Planning

Teacher Planning Versus the Rational Model

Clark and Yinger (Note 3) note that most work on teacher planning contrasts with the rational model of curriculum planning first proposed by Tyler (1950) and later elaborated by Taba (1962) and Popham and Baker (1970a, 1970b). This model calls for an initial focus on objectives, followed by generation or identification of activities that might be useful in accomplishing those objectives and selection from among these alternatives, activities that are most appropriate or useful. The research on teacher planning indicates that teachers virtually never follow this model. Instead, their planning time is concentrated on the content that they will be teaching and the activities that are built into the curriculum. Objectives, if considered at all, are taken into account only within the contexts of these activities and only after the strategies and activities themselves have been studied in detail. These general findings concerning the nat-

uralistic course of teacher planning were reported in earlier work by Joyce and Harootunian (1964), Zahorik (1970), and Goodlad and Klein (1970). These results have been replicated in the studies done since that time, although more recent studies have investigated other questions as well.

The only study to depart much from this set of findings was one by Taylor (Note 4) concerned with the planning of course syllabi by British teachers of secondary English, science, and geography. This was a study of curriculum planning by groups of teachers rather than of specific instructional planning by individual teachers, and concern about instructional objectives was more in evidence. Even so, the data did not indicate that teachers followed the rational model. Planning typically began with consideration of the teaching context (materials and resources), followed by consideration of pupil interest and the kinds of activities likely to appeal to pupils. The aims and objectives of courses were considered only after these factors. Instructional evaluation was considered last, if at all. Taylor's study indicates that teachers do not follow the rational model even when explicitly acting in the role of curriculum planners. Later work indicates even more clearly that they do not follow this model when planning the specific instruction that they will carry out in their classrooms.

Zahorik (1975) inferred teachers' planning models from their answers to questions about the decisions they made prior to instruction. Decisions were classified as dealing with objectives, content, activities, materials, diagnosis, evaluation, instruction, and organization. Frequency data indicated that decisions about activities were made most often. Data on the order of decisions indicated that 51% of the teachers made their first decision about the content, and only 28% made their first decision about the objectives. Further analysis revealed that specification of objectives was not an especially important planning decision, and that even when it occurred, subsequent planning decisions did not always follow logically from the objectives specified.

Peterson, Marx, and Clark (1978) studied planning decisions by asking 12 experienced teachers to think aloud while planning for teaching an experimental social studies unit to each of three groups of junior high school students. The same lesson was repeated to 3 different groups on different days, with the students being previously unknown to the teachers in each case. Like Zahorik, these investigators found that the teachers spent most of their planning time dealing with the content (subject matter) to be taught, followed by consideration of instructional processes (strategies and activities). The needs and characteristics of the students received relatively little attention, as did the materials, but this is to be expected in an experimental study in which the materials are standardized and the students are unknown to the teachers. Only 4% of the planning statements dealt with objectives, the least of any of the categories.

Peterson, Marx, and Clark also correlated teachers' planning behavior with other teacher characteristics, instructional behavior, and learning outcomes. They report that teachers who were more verbal (scored higher on a vocabulary test) verbalized more planning statements and more statements dealing with higher level concepts rather than lower level facts. In contrast, teachers low in conceptual level (Hunt, Greenwood, Noy, & Watson, Note 5) made relatively more statements about the learners and about instructional processes. Thus, the more verbal and well differentiated teachers could be characterized as more subject-matter oriented, and the teachers lower in conceptual level as more pupil oriented. Most correlations between teacher planning variables and teacher behaviors during instruction were sensible. Teachers who stressed subject matter in their planning tended to be subject-matter oriented in their teaching; teachers who stressed instructional processes in their planning tended to be oriented relatively more to maintaining group cohesion and participation than to imparting subject matter; and teachers who stressed higher order objectives in their planning tended to stress higher order cognitive objectives in their teaching.

The data on outcomes from this study are puzzling, however. First, contrary to expectations, data on student achievement and attitudes indicated that teacher effectiveness dropped across the three days of instruction: Teachers were less effective in teaching the unit to the third group of students than they had been with the first group. Furthermore, the more prolific planners (teachers who made more planning statements) produced higher student achievement the first day but not thereafter, and also received lower student attitude scores for all three days. These less favorable student attitude results were especially likely for teachers who stressed subject matter in their planning. As the authors note, "after the first day of teaching, this extra planning was counter-productive with regard to student achievement, and actually was associated with negative student attitudes toward the subject matter, teacher, materials, and selves as learners " (p. 429).

These findings contradict the common sense expectation that more thorough planning would lead to better instruction, but they are not unique. Zahorik (1970) included in his study a comparison of the teaching behavior of six teachers who had been given time to plan a lesson with that of six other teachers who did not see the lesson until shortly before they were to teach it. Zahorik noted that the teachers who had been given time to plan were less sensitive to the students during instruction, at least in the sense that they were less likely to permit, encourage, or develop students' ideas. He concluded that an emphasis on the goals, activities, and content of instruction during planning might result in insensitivity to, and thus a reduced capacity to capitalize upon and use, students' ideas during the lesson. Taken together, these two studies suggest that planning can be counterproductive if it causes teachers to become singlemindedly concerned with subject matter and instructional methods, to the point that spontaneity and openness to student ideas suffer.

Morine-Dershimer and Vallance (Note 6) collected written plans for reading and mathematics lessons from elementary school teachers participating in the Beginning Teacher Evaluation Study (BTES). Most of these took the form of fairly specific outlines of the order and content of activities to be included in lessons, but they contained little information about goals, diagnosis of student needs, evaluation procedures, or possible alternative courses of action. However, the teachers reported that this was not their normal style of preparing for lessons, and comparison of lesson plans with actual activities during lessons revealed that teachers had made many preactive decisions about instructing their students that were not mentioned in the written plans (Morine-Dershimer, Note 7).

In a more naturalistic follow-up study (Morine-Dershimer, Note 7), teachers were asked about their plans for reading lessons that were to be observed later in the day. Teachers' responses to this general request to state their plans consistently mentioned the content to be covered and the activities to be engaged in, and often mentioned the material to be used as well. Factors such as pupil ability, specific objectives, teaching strategies, or seating arrangements rarely were mentioned spontaneously, but responses to follow-up probing questions indicated that the teachers possessed mental plans or "images" of the lessons to be taught which did include these aspects of instruction. Thus, these images were more detailed and included more aspects of lessons than typically are mentioned in response to general questions about lesson plans. Joyce (1978-1979), commenting on this phenomenon, hypothesizes that teachers conduct long term, preactive planning early in the year that sets up an activity flow. This activity flow then establishes the problem space (cf. Newell & Simon, 1972) within which lesson planning and interactive decision making are conducted. Yinger (Note 8, Note 9) makes a similar point in noting that long range planning early in the year involves setting up of routines that continue throughout the year and establish stable

contexts within which later planning will be conducted. Once these routines prove effective and become well established, they simplify future planning tasks by reducing the number of considerations that must be taken into account in such planning. It may be that instructional objectives, as well as other factors not often mentioned in teachers' responses to questions about their instructional planning, may play an important role in teachers' thinking as they establish activity flows or routines, and thus may be more involved in teachers' lesson planning than the data seem to suggest. In any case, the work of Morine-Dershimer and others (to be described) indicates that the thinking teachers bring to bear in preparing for instruction is both broader and deeper than what they include in their lesson plan.

Yinger (Note 8) studied the planning and instructional activities of a single elementary-school teacher across a five month period. Yinger discusses planning at five levels: Yearly, term, unit, weekly, and daily. Data from the unit, weekly, and daily planning sessions (studied with a "think-aloud" method) replicated other work indicating a focus on content and activities. However, data concerning the term and especially the yearly planning indicated more attention to objectives and to other considerations not usually included in more short term planning. These included the above mentioned establishment of routines that could be relied upon for the rest of the term or year to reduce the complexity and increase the predictability of classroom activities.

Smith and Sendelbach (Note 9) have been studying the planning of science lessons by elementary school teachers (sixth grade). They have initiated a series of studies designed to (1) analyze the literal program approach to instruction as outlined in the teacher's guide, (2) analyze the teacher's intended approach developed in preactive planning, (3) analyze the teacher's actual approach as used in

interaction with students, and (4) relate these variables to learning outcomes. Work to date has concentrated on the first three issues.

In the first study, four sixth-grade teachers were asked to think aloud while planning to teach a unit from the Science Curriculum Improvement Study (SCIS) curriculum that stresses exploration and discovery. The think-aloud data were later supplemented with stimulated recall procedures and probing questions to elicit more information. The focus was on comparison of the literal program approach built into the SCIS curriculum with the teacher's intended approach as developed during the planning.

The data revealed that the teachers made only sketchy notes, but had detailed plans of their intentions concerning activities and anticipated student responses during the lesson ("images" of the lesson, as Morine-Dershimer would call them). Written notes were just minimal cues and reminders to activate *plans-in-memory*. The organization of the notes was episodic--based on time sequence--because activities were the basic units. In addition to activities, teachers referred often to sequencing, handling discussions, and managing materials and equipment, but not to objectives.

The teachers varied in their use of SCIS materials (although most used most materials) and especially in the degree to which they followed the SCIS goals and strategies. Only one of the four teachers was faithful to the SCIS discovery-learning approach.

In general, the teachers paid little attention to the overall goals of the SCIS curriculum and the sequencing of activities built into it. Instead, they picked and chose among the activities, selecting those they saw as attractive or appropriate for their students and as covering the concepts or skills (especially low-level information) that they deemed important for their students to learn.

In effect, they treated the curriculum as a menu from which to select desired items rather than a structured and sequenced course of objectives to be worked through in their entirety and in the proper order.

Smith and Sendelbach note that plans were not so much formulated as reconstructed from memory, with emphasis on what to do and how to do it.

In a second study, Smith and Sendelbach compared plans with actual classroom approach by observing the instruction of one of these four teachers in her classroom. The teacher had had nine years of teaching experience, but this was only her second year using the SCIS science curriculum. This teacher used only the teacher's guide during planning (not the materials or the student activities). She used most of the activities called for in the curriculum, but not always with the recommended instructional methods and not always in combinations that would be appropriate for achieving the outcomes envisioned by the SCIS curriculum writers. Some of these deviations from the SCIS curriculum were deliberate, but others were not, and in either case the teacher did not seem to see the implications of making these changes. The non-deliberate deviations stemmed from problems such as limited subject-matter knowledge, difficulty in finding needed information in the teacher's guide, or difficulty in grasping inherently complex concepts.

Smith and Sendelbach found that, in general, deviations from the guide were not improvements. Furthermore, the teachers they studied often had (and knew that they had) poor lessons, but did not know what to do to change them for the better. They did not have enough command over the subject matter and the methods of teaching it to be able to adjust by generating alternative paths to the same goals. Thus, if lessons were not working, the teachers were stuck with pursuing the same plan anyway or simply dropping the lesson. (Several studies reviewed in a later section on teachers' interactive decision making revealed similar findings)

Teacher Perceptions of Planning

My colleague Chris Clark, of the Institute for Research on Teaching, has conducted several studies of teacher planning in addition to his work with Marx and Peterson reviewed earlier. Three of these studies were done with Yinger and are reviewed in Clark and Yinger (Note 3). The three studies were (1) a survey of teacher planning practices, (2) a laboratory study of teacher judgment in planning, and (3) a field study of the relationship between teacher planning and teacher implementation of instruction.

The planning survey study involved collecting responses from about 70 elementary school teachers to a list of questions about planning. In addition to answering the questions, the teachers were asked to select and describe examples of plans representing the three most important types of planning that they did during the year. The authors summarized their results as follows:

> Learning objectives are seldom the starting point for planning. Instead, teachers plan around their students and around activities.
>
> Teachers tend to limit their search for ideas to resources that are immediately available, such as teacher editions of textbooks, magazine articles, films, and suggestions from other teachers.
>
> Teachers indicated that most of their planning is done for reading and language arts (averaging 5 hours/week), followed by math (2.25 hours/week), social studies (1.7 hours/week), and science (1.4 hours/week).
>
> Teacher planning is more explicit and involves a longer lead time in team-teaching situations than in self-contained classrooms.
>
> The most common form of written plans was an outline or list of topics to be covered, although many teachers reported that the majority of planning was done mentally and never committed to paper.
>
> Planning seems to operate not only as a means of organizing instruction, but as a source of psychological benefits for the teacher. Teachers reported that plans gave them direction, security, and confidence. (p. 15)

A laboratory study of teacher judgment in planning involved asking teachers to make judgments about language arts activities from a set of activity descriptions that varied in five characteristics: student involvement, integration, difficulty, fit between purpose and process, and demand on the teacher. Some of the teachers studied were asked to think aloud during this process, so that the investigators could trace the thinking and judgment processes that they used (process tracing) and characterize their judgmental decisions (policy capturing). Twenty-five elementary teachers in the upper grades participated, six of whom verbalized their thinking aloud in the process.

Preliminary results based on analyses of 19 of the teachers indicate that the five activity dimensions manipulated in the stimulus descriptions account for as much as 50% of the variation in the ratings of some teachers but show no systematic relationships to the ratings of other teachers. The activity dimension that contributed most frequently as a predictor of teacher judgment was student involvement, followed in order by integration, difficulty, fit between purpose and process, and demand on the teacher.

The process data indicated a four-step process in making judgments about activities. First, teachers tried to understand the activity. Second, they imagined using it in the classroom. Third, they thought of ways to modify or adapt the activity to avoid problems foreseen at step two. Fourth, they created a mental image of the revised version of the activity. Later, when questioned about activities, it was this mental image that the teachers constructed, rather than the original version, that they used in responding.

The field study of teacher planning and plan implementation involved asking teachers to plan a two-week unit on writing that had never been taught before.

Three weeks were allowed for planning followed by two weeks for enactment in the classroom. Teachers kept journals documenting their plans and their thinking about planning, and this information was supplemented with bi-weekly interviews and classroom observations.

Analysis indicated that each of the plans was unique. No two plans contained the same topics and activities. Planning was not a linear process moving from objectives through design of activities to meet objectives, but instead was a cyclical process typically beginning with a general idea and moving through phases of successive elaboration. Some teachers spent a great deal of time and energy at the problem finding stage, generating topics or ideas for their unit. The search process typical of this stage was very different from the elaboration and refinement of the idea that took place in the subsequent problem formulation/solution stage. These and other data fit the planning process models developed by Yinger (Note 8).

Two of the plans involved little time spent generating ideas (a short problem finding stage, brief unit planning, and considerable reliance on trying out activities in the classroom). Clark and Yinger (Note 3) referred to teachers using this method as *incremental* planners who prefer to move in a series of short planning steps, relying on day-to-day information from the classroom. This is in contrast to the processes used by *comprehensive* planners who are more concerned about developing a general framework for future action. Comprehensive planners are more concerned with the unit as a whole, and more careful to specify their plans as completely as possible before beginning to teach.

Incremental planners were concerned mostly with activities -- how to get the unit started with an effective classroom activity, and then where to go from there. They valued spontaneity in their teaching and staying in close

contact with the needs and states of their students and their methods of planning and implementation enabled them to do so. However, this advantage was gained at the expense of not always knowing where they were going, as well as being less likely to have specific alternatives in mind and thus being able to shift quickly when difficulties were encountered.

The comprehensive planners developed detailed long range plans but usually tried out these plans and the activities within them only mentally or vicariously Thus, their plans were built on their predictions about how students would react rather than on direct experiences with them. Elaborate images of the lesson including what to anticipate from students were developed, and when unanticipated events occurred during lessons the teachers could refer back to their elaborate plans in trying to decide what to do. Having the plan to fall back on was a major advantage for the comprehensive planners, but disadvantages included a great deal of time and energy involved in creating such plans, as well as the danger that the teacher would feel locked into the plan and might be less flexible in adapting to students.

Although comprehensive plans would seem to be more effective (*if* teachers remained flexible and open to student reactions), Clark and Yinger (Note 3) report that both kinds of plans seem to be adaptive *for the teachers who use them.* They are not prepared to state that one kind of plan is better than another.

As an aside, Clark and Yinger report that the process of keeping a journal was a very powerful experience for the teachers who undertook it, teaching them a great deal about their own thinking and teaching. In particular, until they kept detailed reports, they did not realize how much thought and energy they put into their planning, and in this sense did not fully appreciate themselves as professionals. An implication of this is that planning studies comparing teachers with non-teachers or teachers at various levels of expertise with one

another might be a promising strategic research site for identifying the elusive professional expertise that Popham (1971) and others have had difficulty demonstrating in studies of interactive instruction.

Clark and Elmore (Note 10) interviewed five elementary school teachers and observed in their classrooms during the early weeks of school, because earlier work had suggested that teacher planning is especially important during that time. They found that in addition to subject matter planning, teachers plan for the physical environment of the classroom, assessment of student knowledge and abilities, and establishing a workable social system in the classroom. Schedules, routines, new curricular materials, and groupings are pilot-tested and adjusted. After about a month, a workable system develops, which then characterizes the rest of the school year with only minor modifications. Other descriptive research suggests a similar picture of the earlier weeks of school (Shultz & Florio, 1979; Yinger, Note 8; Buckley & Cooper, Note 11; Tikunoff & Ward, Note 12; Anderson & Evertson, Note 13).

In a recent paper, Clark and Yinger (Note 14) reflect on research on teacher planning and its possible implications. They note that teacher planning typically is an intuitive design process, not a rational decision making process, and that teachers virtually never generate alternative plans and then choose the best ones. Teachers typically see weekly planning as the most important form of planning they do, even though teacher education programs tend to stress lesson and unit planning. In general, the content of teacher education programs with respect to teacher planning is out of fit with what actually goes on among inservice teachers.

For most teachers, a major outcome of planning is better learning of the material that they are about to teach. Teachers frequently are unfamiliar even

with the specific knowledge taught in a lesson, let alone the overall curriculum. Clark and Yinger second the call of Ben-Peretz (1975) for better training of teachers to be able to analyze, take apart, reorganize, and reassemble curriculum materials.

Clark and Yinger conclude that good teachers plan well but not rigidly, concentrating on learning the activities and procedures involved in a lesson but relying on previously established routines to handle most events that are likely to arise during interactive teaching with the students.

Where Research on Planning Might Go Next

Taken together, the studies of teacher planning reveal remarkable agreement on how teachers typically plan specific lessons. There is less information available about yearly, unit, weekly, or daily planning, but what there is is internally consistent with itself and with the information about lesson planning. In general, then, it seems clear that few, if any teachers use the rational or linear model of planning, and that most follow the cyclical, activities-centered approach that concentrates on learning what to do and how to adapt it to the pupils. There seems to be little need for further elaboration of this point, although research on teacher planning could make important contributions in several other respects.

First, it seems that more work is needed on how teachers plan at the yearly, unit, weekly, and daily levels. The work to date has concentrated on lesson planning, which might be problematic in at least two respects. First, Clark and Yinger (Note 3) report that teachers see weekly planning as the most important form of planning that they do, and to date this has received little research attention (and practically no attention in teacher education programs). Second, the work of Yinger (Note 8) and of Clark and Elmore (Note 10) indicates the need for more attention to the planning that goes on at the beginning of the year and the

routines that are established then. It may be that what goes on during planning at this level is at least as important in determining the outcomes of lessons as the specific planning of lessons themselves.

Several investigators have noted that the traditional emphasis on the rational model of planning is out of fit with the kinds of planning that teachers actually do, and have suggested that teacher education programs should begin to stress the naturalistically used process rather than the rational model. It may be that this is the case, but the data available at the moment do not rule out the possibility that the rational model has never seriously been tried. That is, the fact that teachers do not typically use it does not mean that they have tried it and found it wanting. It may be that they were never trained to use it properly.

It may also be, however, that the rational model is generally inappropriate for teachers, especially teachers who will be working with curricula that have been selected by someone else (in the United States school administrators typically select curricula) and arrive in finished form, sequenced according to a rational model and accompanied by various items of equipment for use by the teacher during instruction and consumables for use by students. This state of affairs does not encourage the teacher to think or function as a curriculum planner, and in many school districts teachers will be actively discouraged from doing so. Where this is the case, it should not be surprising to find teachers concentrating on "What am I supposed to do and how will I do it?" rather than on specifying educational objectives and systematically developing curricula designed to meet them. Perhaps research on teachers in other countries (or even in certain settings in the United States) where responsibility for establishing educational objectives is located with the individual teacher rather than higher authority, and where teachers are expected to identify or create their own materials, might

reveal a greater tendency to use the rational model (or at least a greater tendency to take into account instructional objectives).

The writings of Ben-Peretz, echoed by Clark and Yinger, are also relevant in this regard. Few teachers have had extensive training or experience in putting together and taking apart curricula, so they can be expected to have difficulty doing so even where they do see this as part of their role. Comparisons of planning by teachers who have had this kind of training and experience with the more typical teachers might be instructive, as would comparisons of teacher planning in cases where a curriculum was carefully introduced with situations where the curriculum was "thrown at" the teachers with minimal preparation or explanation.

Also, I would like to see this line of research move beyond the level of mere description and begin to identify aspects of *quality* in teacher planning. Clark and Yinger's contention that different approaches to planning may be equally effective for teachers who use them is well taken, but still it seems likely that within these general approaches, certain teachers will plan more successfully than others. For example, among those teachers who emphasize content, some may be overly narrow in their purview or overly rigid in their planning (as the work of Zahorik and of Peterson, Marx, & Clark suggests). In addition, among the teachers who use what Clark and Yinger have called an incremental approach to planning, it seems likely that some will be committed to the approach because they have thought a lot about it and tried out alternative methods before arriving at an intelligent and experience-based decision, but that others will be operating at a much less sophisticated level at or only barely beyond the stage of mere survival in the classroom. In any case, it seems clear that research on teacher planning will have to develop ways to

conceptualize, measure, and document differences in quality if it is to develop prescriptive implications for teacher education.

Finally, it should be noted that teacher planning research to date (as well as the research to be described on teachers' judgment and decision making) has been concentrated at the elementary grade levels. Virtually nothing is known about the mental life of secondary teachers. It may be that they spend more time thinking about curriculum and objectives, because they usually stress their role as subject matter specialist over their role as socialization agent and authority figure.

Judgment

Teachers exercise judgment when they categorize (such as when assigning students to ability groups) or when they select among alternatives those that seem most promising for solving a problem. According to Clark and Yinger (Note 3), research to date on teachers' judgment has involved attempts to describe the judgment processes, to investigate the accuracy of teachers' judgments, or to explore the degree to which teachers are sensitive to the amount and reliability of information available. Many of these studies involve investigating questions and using methods described by Tversky and Kahneman (1974) and by Shavelson (1976).

Tversky and Kahneman (1974) discussed the heuristics that people use in making judgments about other people and events. In particular, people tend to be insensitive to the reliability of information, so that they frequently use unreliable information as if it were reliable in decision making, and they tend to overreact to and overvalue perceptions that occur early in a sequence relative to those that occur later. In research on teachers, the use of unreliable information is seen in numerous studies indicating that teachers can and sometimes will make predictions about student achievement on the basis of such factors as race, handwriting neatness, or physical attractiveness (many such studies are reviewed

in Brophy and Good, 1974). A tendency of first impressions to anchor later perceptions is seen in several studies indicating that students who do well early and then tail off later tend to receive higher performance ratings or predictions of future achievement than students who begin poorly but improve over repeated trials to the point that they earn the same average score as those who started successfully but then deteriorated (Murray, Herling, & Staebler, Note 15, Feldman & Allen, Note 16, Note 17).

Shavelson, Cadwell, and Izu (1977) accept the conclusion of Tversky and Kahneman that people in general are not very good decision makers, but also review studies indicating that experts making decisions in areas of their expertise, possibly including teachers making decisions about students, may be less subject to typical errors in decision making. They tested this notion in an experimental study in which teachers were presented with information about a fictional 10-year-old student. Different versions of the description of the student included information about social class background, work habits, and intelligence, but this information was sometimes reliable (obtained from interviews with parents or from intelligence tests) and sometimes unreliable (statements by a peer who admittedly did not know the student very well). Teachers were asked to read the information and then predict the probability that the student would get high grades, indicate the appropriate grade level for placing the student in reading and math, state the strategy they would use if they asked the student a question and he hesitated rather than answering, and estimate the student's need for praise. Following this, they were given additional information about the student and asked to repeat the same four judgments.

Results indicated that teachers were sensitive to the reliability of the information they received, and furthermore that they were willing to revise their initial decisions when presented with new information.

Teachers' Theories About Teaching Guide Teacher Judgment

These findings were restricted to predictions of achievement, and none of the information was considered particularly relevant to decisions about how to respond when the student failed to answer a question or about how much praise the student needed. Apparently, teachers' decisions about these instructional issues depended on their theories or beliefs about teaching, rather than the student's social class, work habits, or intelligence.

Later work by Shavelson and his colleagues is described in the chapter by Borko, Cone, Russo, and Shavelson (1979). The authors refer to a (fictional) elementary level mathematics lesson in illustrating the points they discuss.

The first study described above dealt with the accuracy of teachers' estimates and the effects of these estimates on decisions. The second study dealt with pre-instructional decisions of teachers concerning reading and mathematics instruction. For this study, elementary teachers were given descriptions of hypothetical second grade students who systematically varied in sex, reading achievement, mathematics achievement, class participation, and appropriateness of classroom conduct. After reading the descriptions, teachers estimated (1) the likelihood that the student would master most of the concepts and skills of the second-grade reading curriculum, (2) the likelihood that the student would master most of the concepts and skills of the second grade mathematics curriculum, and (3) the likelihood that the student would be a behavior problem in the classroom. Following this, they grouped the students into reading groups and into mathematics groups, and then made decisions about teaching standardized reading and mathematics lessons to the groups.

Analyses indicated that teachers based their estimates of student achievement and classroom conduct on the cues most relevant to the estimates. Thus, predictions about reading achievement were based mostly on information about prior achievement in reading, predictions about mathematics achievement were based mostly

on information about prior achievement in mathematics, and predictions about classroom behavior were based mostly on information about previous classroom conduct.

Grouping decisions were based mostly on achievement data, although teachers differed in the degree to which they used only information about reading achievement in forming reading groups and about math achievement in forming math groups versus using information about achievement in both subject areas.

Decisions about appropriate strategies for teaching reading and mathematics were based on a variety of factors including educational beliefs, the ability level of the group being taught, and the instructional objectives. Progressive teachers tended to emphasize inquiry approaches and traditional teachers to emphasize lecture or recitation approaches. Manipulable materials were usually selected for mathematics lessons, but more abstract materials such as pictures or verbal representations were selected for reading lessons. More time was allotted for motivational activities for low achieving groups than for high achieving groups.

Teachers Make Reasonable, Informed Decisions

Additional studies in this series have been conducted and are continuing at present. So far, all of the findings are consistent with the notion that teachers' decisions are reasonable and based on the most relevant information available. These data from the Shavelson et al. (1977) yield a somewhat more positive description of teacher judgment and decision making than the data from other investigators do. For example, Mondol (Note 18) gave student teachers information about the socioeconomic status, IQ, grades, sex, and personality of ficticious students, and asked them to judge the probability that the students would pose instructional problems in the classroom. Student teachers without special feedback and training tended to overreact to certain information items and slight

others, although they were able to learn to weight the items equally following feedback and training.

Marx (Note 19) asked experienced teachers of experimental social-studies lessons to group junior-high school students, with whom they were not previously acquainted, and to predict student achievement and attitudes on the basis of their observations during the 50-minute lesson. Marx reported that the teachers were not good predictors of cognitive achievement and were only slightly better for student attitudes. However, there is little reason to expect accurate prediction under these conditions. The teachers' contact with the students was limited to a single 50-minute lesson during which they (the teachers) had to be concerned mostly with putting across subject matter to the group. Consequently, they had little knowledge to base predictions on other than degree of student participation in this single lesson, and this was neither a very reliable nor very powerful information base.

Other studies done under more naturalistic conditions reveal that teachers observe a great deal about student performance and generally use this information appropriately to develop generally accurate impressions of ability and predictions about future performance. For example, Willis (Note 20) asked first-grade teachers to rank their students on predicted end-of-year achievement during the first week of school, when they had had only a few days of experience with the children. These early rankings correlated .58 to .64 with another set of rankings obtained at the end of the semester, and correlated .56 to .63 with scores from a readiness test administered after several weeks of school. Furthermore, interviews with the teachers designed to identify the criteria they used in making these judgments indicated that they gave most attention to self confidence, participation in classroom activities, general maturity, and ability to work well independently without close teacher supervision. Later, after a few weeks of experience with the students, even more weight was given to performance in reading as observed

during class, and to scores on the readiness test. In general, the Willis data are consistent with the findings of Shavelson and his colleagues indicating that teachers tend to base their judgments on the best information available and are willing to revise these judgments when new information comes along. Long and Henderson (Note 21) report similar findings.

Clark and Yinger review several studies of teacher judgment that deal with issues other than prediction of student achievement or decision making based on estimated student achievement. These include studies of the kinds of categories that teachers use when asked to sort their students into categories of their own choosing, and of the kinds of reasons that teachers give when asked to rate the appropriateness of various activities for their students and explain the reasons for their ratings.

Research on Teacher Judgment Not Yet Structured or Directed

Compared to the research on teacher planning, the work on teacher judgment has yet to "jell" as a subfield with structure and direction.

Part of the problem, in my opinion, is the reliance on highly unrealistic experimental situations that appear to differ in crucial ways from the naturalistic milieu for teacher judgment. The information included in the judgment tasks used by Shavelson and his colleagues, for example, is both limited and oversimplified, perhaps so much so that it forces the kinds of results that it yields and at the same time does not allow teachers to draw on their professional expertise. Any reasonably intelligent and logical person would respond to these situations the way that teachers have been observed to do.

Furthermore, these experiments, in effect, short-circuit the judgment process by presenting teachers with pre-selected, digested, and summarized information. I suspect that in the naturalistic situation this process of sorting, collating, and determining the relative reliability and relevance of various items of

information is at least as important in teachers' judgments as using the assembled information to make decisions. Thus, I think that studies of teacher judgments should use methods more like those developed by Vinsonhaler (Note 22) and his colleagues for studying clinical diagnosis of reading and learning disabilities.

Another problem that I have with the existing work on teachers' judgment and decision making is that it tends to read too much conscious deliberation and choice into the teacher's mind. For example, Borko et al. (1979) state explicitly that:

> When teaching is viewed as a decision-making process, the teacher is seen as an active agent who selects a teaching skill or strategy in order to help students reach some goal. This choice may be based on one or more factors. If all of the types of information mentioned above were used, teachers would need to integrate the large amount of information about students available from a variety of sources and somehow combine this information with their own beliefs and purposes, the nature of the instructional task, the constraints of the situation, and so on, in order to select an appropriate instructional strategy. (p. 138)

I submit that although teachers sometimes make decisions in this conscious and organized way, they usually do not, particularly in their interactive behavior in the classroom. Borko et al. imply that all teaching behavior results from decision making, although they recognize that conscious decision making does not always occur: "sometimes teachers are aware of their decisions, and sometimes they make them automatically" (page 138). I am not sure that it is profitable to assume that all teacher behavior reflects decision making, or to use a term like "decision making" to refer to behaviors that appear to result from conditioning processes and proceed without *conscious* awareness or monitoring, let alone deliberation and choice. I believe that it is more profitable to reserve the term "decision making" for *conscious* decision making, and use the terminology associated with concepts like modeling, conditioning, and learning to refer to behavior that, even if systematic, was never deliberately adopted after conscious evaluation or deliberation.

Interactive Decision Making

Clark and Yinger (Note 3) describe studies in this domain as follows:

> Interactive decision making refers to decisions made during the act of teaching. The teacher is seen as constantly assessing the situation, processing information about the situation, making decisions about what to do next, guiding action on the basis of these decisions, and observing the effects of the action on students. The fundamental question underlying this work is: How much teaching is reflective, and how much is reactive? The portion of teaching that is reflective is what interests those who study the interactive decision making of teachers.
>
> All studies of interactive decision making by teachers depend on the teacher's self-report of the decision made. The most common method of obtaining self-report data is some variation of a procedure in which a videotape of the teacher's teaching performance is replayed to stimulate recall of the teaching situation. In some studies only short segments of the videotape are replayed, while in other studies the entire videotape is replayed. In the latter case, the videotape may be stopped by the teacher when he or she remembers having made a decision, or the researcher may control the identification of "critical incidents." In most cases, the teacher is asked a standard set of questions after viewing each videotape or segment. (pp. 247-248)

The Effect of Teacher Experience

The first study of interactive decision making by teachers (Peterson & Clark, 1978) was conducted along with the study by Peterson, Marx, and Clark (1978) on teacher planning described earlier. Twelve experienced teachers taught an experimental social studies unit to three different groups of eight junior-high students with whom they were previously unacquainted. Interactive decision making was studied by videotaping the teachers during instruction and then replaying four brief segments and asking them questions about what they were doing during each segment, what they noticed about students, whether they had objectives in mind,

whether they were considering alternative strategies, and whether anything in the situation caused them to change their planned strategy.

The findings revealed that teachers considered alternative strategies only when the teaching was going poorly. The primary cue they used to judge how the lesson was going was student participation and involvement. In 65% of the taped segments sampled, teachers said they were not thinking about alternatives because things were going well. In 10% of the segments, the teachers noted problems but could not think of alternatives. In 7% of the segments, they noted problems, thought about alternatives, but stayed with their original plan nevertheless. Finally, for 18% of the segments, the teachers reported changing to alternative strategies. Thus, teachers changed only about half of the time that they noted problems. When they did not change it was sometimes because they could not think of alternatives, and sometimes because they apparently believed that the alternatives were even less likely to be successful than the original plan. In any case, relatively little of the interactive decision making of these teachers involved major changes in plans. Instead, most of it involved fine tuning of the basic lesson plan and adaptation to situational aspects that are unpredictable in principle, such as specific student responses.

The teachers in this study repeated the same lesson three times to different groups of students, and Peterson and Clark (1978) report an experience effect: Instances in which the lesson went poorly and the teachers could not think of alternatives dropped across the three replications. They also report that this problem was associated with the verbal ability (assessed by a vocabulary test) of the teachers; the more verbal teachers were less likely to report inability to think of alternative strategies. Conversely, teacher verbal ability correlated positively with availability of alternative strategies.

Some Teachers Stick with Plan No Matter What

Correlation of interactive decision-making scores with planning scores in this study yielded some intriguing findings. In particular, there was a positive relationship between planning that emphasized the instructional objectives (versus the activities or the needs of the students) and the tendency to stay with the original plan even when it was not succeeding. This again suggests that planning that is directed exclusively to content and objectives may produce overly rigid instruction that is insufficiently open and adaptable to student needs.

In general, teachers who stressed instructional processes in their planning were more likely to change to alternatives than teachers who stressed subject matter, especially lower level factual learning. Thus, process oriented teachers were more likely to change plans than content oriented teachers. It should be noted, however, that many teachers did not need to change plans because their plans were working successfully, so that changing plans is not necessarily a positive indicator of instructional effectiveness in its own right.

Correlations with learning outcomes indicated that teachers who stayed with their plans even when they were not working were less successful in producing student achievement and positive attitudes. Teachers who stayed with their plans because they did seem to be working tended to produce higher student achievement on lower level cognitive objectives, whereas those who recognized problems and shifted to alternative strategies tended to produce higher student achievement on higher level cognitive objectives. These data are provocative and indicate the potential of this kind of research to make important contributions the literature on teacher effectiveness. However, it seems clear that analysis techniques must be developed to separate issues regarding the need for

change in plans and the reasons for this need from issues regarding the availability and implementation of effective alternative strategies.

Teacher Planning and Classroom Reality

Morine-Dershimer and Vallance (Note 23) used a stimulated recall test to study the decisions made by second- and fifth-grade teachers categorized as either more or less effective. They found that most decisions related directly to preactive decisions made during planning or involved responding to instantaneous verbal interaction. Very few decisions involved the inclusion of activities not originally planned for the lesson. The teachers focused on instructional processes when discussing the substance of their decisions, but when asked about the basis for these decisions they shifted to pupil characteristics.

Interestingly, the teachers classified as less effective mentioned a greater number of items that they were taking into account in their decision making than those classified as more effective. This seems counterintuitive, at least at first, because it seems that teachers who are processing more information should be more perceptive in the immediate situation and/or more able to bring relevant concepts and experiences to bear in making their decisions. Yet, the literature on decision making, particularly the work of Newell and Simon (1972) from which researchers on teachers' decision making have borrowed heavily, suggests that it is important to cut down on the complexity of decision making by carving out a small "problem space" within which to work. Further, the studies of medical decision making reported by Shulman and Elstein (1975) indicate that experienced diagnosticians do not methodically work through all of the possible alternatives, but instead move quickly to testing their hypotheses about the most likely sources of the problem. Often they generate only a single hypothesis and stay with it until it is either confirmed or rejected. The Morine-Dershimer and Vallance (Note 23)

suggest that something similar might be going on with teachers. That is, perhaps the more effective teachers (and probably also experienced teachers compared to inexperienced teachers) have learned to cut through the complexities and identify and monitor only those aspects of the teaching situation that are most reliable and relevant for interactive decision making. Furthermore, they may have honed down their lists of viable alternatives for a given situation by eliminating those that they have found to be ineffective. If this is the case, their information processing and decision making would be less complex as well as more efficient and effective. This is a line of investigation that seems well worth pursuing.

More recent work by Morine-Dershimer (Note 7) involved use of stimulated recall techniques to study interactive decision making by elementary teachers during reading lessons taught to high- and low-ability groups. Interviews were conducted at four different points in the school year, to investigate changes over time. Information was collected about teacher planning, as well, so that the two sets of data could be correlated.

Teachers were asked about the degree to which they were surprised or disturbed by events occurring at decision points in their lessons, and this information was used to classify lessons into three types. The first type involved little or no discrepancy between teachers' plans and the reality of what occurred during the lesson. Fewer than 25% of the decision points involved unexpected events, and these were not especially disturbing to the teacher. In such lessons, decision points were handled by established routines, and the teachers' information processing during interactive teaching mostly involved responding to their own preformed images of the lessons and the pupil. Decisions were later explained or justified on the basis of the teachers' beliefs about what kinds of treatment

students needed or about how they were likely to respond to the content or the teacher. These beliefs apparently were correct, or in any case were not contradicted by the realities of the lesson, so that the teachers were not forced to change either their plans for the lesson or their images about students and about how the lesson should be adapted to them. Few on-the-spot decisions or considerations of alternatives were reported, because they were not needed.

The second type of lesson revealed minor but not critical discrepancies between plans and reality. Here, 50% or more of the decision points involved unexpected events, but less than 25% were disturbing or bothersome to the teacher. Here, the teachers' preformed images of the lessons were disturbed by unexpected pupil reactions. These were usually minor (pupils understanding a question in a way different from that intended by the teacher, as opposed to a major problem like showing boredom or irritation with the lesson). Morine-Dershimer reports that these minor problems could be handled through immediate "inflight" decisions. Information processing had to become reality oriented rather than image oriented, because the teachers were forced to observe what the students actually were doing rather than to continue to respond to their own preformed images and expectations. Nevertheless, the unexpected pupil reactions did not threaten learning nor invalidate the basic plan, so there was no need for major shifts in approach or activities.

The contrast between these first two lesson types is interesting because it suggests that teachers are likely to observe, and perhaps learn, much more when forced to deal with minor deviations from expectation than when they are able to implement their plans smoothly. Apparently, there is literally more reality contact when things go generally, but not entirely, according to plan than when they go entirely according to plan. I suspect that this is true in all aspects

of life, not just teaching. In any case, the point seems to have implications for teacher education, especially at the inservice level: Can we develop mechanisms to provide feedback to teachers or otherwise help them to maintain good reality contact when they reach the point that most of their problems are solved and handled through automatic routines? Can we help such teachers move to a new level of functioning (Piaget would say a new equilibrium) that will allow them to see challenges and discrepancies that they did not notice before, and thus to revitalize their motivation and ability to remain proactive and perceptive during instruction (and not just to operate on automatic pilot)?

The third type of lesson described by Morine-Dershimer included those in which 50% or more of the decision points were described by the teachers as not only unexpected but disturbing. Here, the problems observed are major ones that threaten student learning and challenge the validity of the lesson plan itself (the material is too difficult for the students, for example, or is so removed from their experience that they cannot respond meaningfully to it). Stimulated recall interviews with teachers who experienced these critical discrepancies between their plans and the realities of their lessons indicated that most teacher comments involved observations of the students that signalled and in some degree described the nature of problems that were arising. These observations about students covered a broader range than the observations typical of teachers experiencing only minor discrepancies (the second type of lesson described above) but they were not often accompanied by discussion of remediation strategies, alternative procedures, or other indications of problem solving. The teachers experiencing critical problems indicated clear awareness of the problems and described them in some detail, but had little to say about how to respond to them and very seldom did respond to them successfully during the lessons in question.

Morine-Dershimer speaks of the decisions in these lessons being handled by postponement. Apparently, this was because, even more than in the Peterson and Clark (1978) study, the teachers did not have readily available and acceptable alternative strategies to shift to. Thus, their choices usually were restricted to either aborting the lesson or continuing with the original plan even though it was clearly not working.

The contrasts between teachers' thinking and decision making in these lessons containing critical problems and their thinking and decision making in the other types of lessons is instructive, as well. It appears that even though encountering a few minor problems makes for better reality orientation than smooth sailing through a plan, encountering serious problems that disrupt the plan itself is a different matter entirely. Problem solving efforts conducted within a context of confidence and response to challenge give way to frustration or panic within a context of resignation and defeat. Again, I suspect that this is not unique to teaching but is a special case of what seems to be true in life generally: The more experienced you are, and the more alternative strategies you have under your command, the more likely you will be able to respond to problems calmly and successfully.

The Content of Teachers' Interactive Decisions

McNair (1978-1979) presents information on the content of teachers' interactive decisions. These data are from the same study (called the South Bay Study) as those of Morine-Dershimer (Note 7).

Of 1,249 teacher decisions coded, 291 dealt with pupil learning (whether or not pupils understood the concept or fact being taught). Another 188 concerned the task (what to require of pupils), 170 concerned facts and ideas (decisions based on perceptions of how difficult the facts or ideas would be for the group,

or how to teach them), and 128 dealt with pupil attitudes (decisions based on pupil attitudes, attentiveness, and the like. Smaller numbers of decisions dealt with such matters as the instructions that the pupils would need, the materials, or student conduct. Only 3% of the decisions concerned instructional objectives. These percentages are of course similar to those obtained in preactive planning studies.

Comparisons of the content of decisions across four times during the year and across the two levels of ability of the reading groups yielded no significant differences, although there was a trend toward more decision making in the low-ability groups, especially concerning pupil attitudes and conduct. This would be expected on the basis of Morine-Dershimer's (Note 7) findings, if it is assumed that teachers were more likely to run into problems in teaching the low-ability groups than the high-ability groups.

In discussing the study as a whole, McNair (1978-1979) notes that the investigators' initial focus on decision making during interactive instruction shifted when they realized that most teacher thoughts at these times involve only minor fine tuning of previously established plans. No major changes in direction occur so long as the lesson goes well, and plans typically are refined in small ways but not scrapped in favor of alternatives. Joyce (1978-1979) expands on this point by emphasizing the importance of the activity flow set up early in the year through preactive planning, and noting that this determines what occurs during lessons much more than interactive decision making typically does.

Decision Making at Critical Moments

Shrover (Note 24) is conducting another study in this vein, dealing with elementary mathematics instruction. The study involves detailed case studies of three teachers, using stimulated recall to study their information processing during teaching and in particular their decision making at critical

moments when things do not go according to plan. Critical moments in this study include not only student difficulties but achievement of important insights and other teachable moments that may strike teachers as worthy of a departure from plans (e.g., to take advantage of an unanticipated opportunity). The elective actions that teachers can take at these critical moments include exploiting the advantages of unanticipated but desirable events, attempting to alleviate problems in learning, or avoiding response to the perceived critical moment in order to get on with the lesson.

Shroyer describes the teacher as working on automatic pilot when things are going well, but maintaining a more active and reality-oriented stance when problems appear (this is similar to the distinction drawn by Morine-Dershimer between teacher information processing in lessons where there are few, if any, discrepancies from expectation versus lessons where there are frequent but minor discrepancies). She also describes teacher responses to four types of critical moments. Analyses are still in progress, but the completed case study of one of the three teachers indicates the following.

The first critical moment occurs when the teacher is unable to explain something to a student who clearly is having difficulty following the lesson. These moments typically occurred when some new content was being introduced. Student difficulty was usually inferred from recurring incidents of failure to respond to questions correctly or repetition of the same error pattern. The teacher's first action here was typically to provide assistance by guiding the student through questioning or giving explanations. This usually persisted even if the student did not immediately grasp the concept, although in one out of four such cases the teacher gave up and returned immediately to the lesson.

In this case, the teacher delayed dealing with the problem by telling the student to keep thinking about it and trying to work it out on his own, apparently because the teacher felt the need to resume leadership of the group at that time. There were not enough data to analyze statistically on this point, but Shroyer believes that this teacher was more likely to delay action and ask a student to continue to try to figure it out on his own if she saw the student as mathematically competent, but more likely to give the student the answer and provide praise (even though the student did not succeed and earn praise) if she saw the student as less mathematically competent. This fits with my own (Brophy, Note 25) observations about how and when teachers use praise.

In explaining why she sometimes did not persist in trying to help students grasp the concept, the teacher sometimes mentioned inability to come up with an alternative explanation, but sometimes also mentioned fear of confusing the student. She projected her own mathematics anxiety in the following quote:

> "Math is like that for me (confusing). And when someone tried to explain it to me it just got worse because I was so upset I wasn't getting it! My whole mind was turned like an eggbeater!"

Other quotes from this same teacher indicate that she consistently assumed that students were overwhelmed by confusion and anxiety if they did not grasp an explanation quickly. This typically happened if the teacher committed herself to helping the student having difficulty and then was unsuccessful in doing so. Fortunately, however, this did not happen to her often. Furthermore, although her immediate response to the situation was poor, she tended to remember the incident and reflect upon it later. This sometimes led to the addition of specially planned activities the next day to address the difficulties that had occurred. This supports the inference of Morine-Dershimer (Note 7) that decision making in critical problem situations is postponed rather than simply abandoned, and points

up the importance of gathering followup data on these situations. It appears that, at least some of the time, teachers do develop and implement alternative strategies for solving problems after they have had a chance to reflect, even though they may not be able to think of such strategies during the interactive situation.

The second type of critical moment described by Shroyer occurred when the teacher responded poorly to a student, and recognized that she had done so. Both of these occurred in connection with student insights rather than problems. In one case, a student was suggesting that one-half is another name for two-fourths, and in the other, the student was asking a procedural question about adding fractions without using the Cuisenaire rods . These suggestions were made only for the first or second time, and dealt with content that had not yet been covered with the class as a whole. Interestingly, the critical moment concerning the alternative name for the fraction occurred in connection with the second time this was mentioned by a student. The student had brought up the same point the day before and the teacher consciously suppressed her urge to exploit it at the time, judging that it would be counterproductive to introduce this point when the class was in the midst of learning something else. The next time, however, she committed herself to exploiting the student's comment, as she also did with the student who asked the procedural question. In each case the teacher began to respond by referring to the Cuisenaire rods, and in the process became confused because she forgot which rod represented which fraction and how to convert from halves to sixths. After recognizing her problem, she continued with her exploitation in one case but aborted the other.

In the latter case, she simply stated that the two fractions were equal and

then quickly moved on with the original lesson, fearing that she might confuse the students if she continued the digression about fraction equivalents at that time. Shroyer believes that the main factor determining the differential response in these two situations was the ready availability of an alternative course of action. That is, she interprets the teacher's overt explanation (fear of confusing the students) as a post facto rationalization that would not have been necessary and probably would not have occurred had the teacher been able to think of an effective way to get across the concept in the original situation.

These first two types of critical moments described by Shroyer deal with specific incidents. The third type occurs as the culmination of a series of events. These occurred during review activities in which students were working on problems and the majority could do them successfully but a few were having consistent difficulty. The teacher was torn between the desire to spend time tutoring the few individuals who were having difficulty and the need to keep things moving for the larger number of students who were finishing problems quickly and becoming ready for more. The teacher gradually became aware of her own frustration over the fact that the task was not appropriate for all of the students within the time allocated, as well as her increasing impatience with the few students who were having problems. She really wanted to get on to other things (and the majority of students were ready for this), but she felt compelled to try to teach those who needed her help.

The teacher's response to these problems was poor, essentially because she had only a single plan and thus saw no other realistic choice but to persist with it. In the process, she compromised her own philosophy and goals by doing

things that she would not ordinarily do: giving the answers and generally shortcutting in her attempts to teach the slower students, rather than persisting with her more preferred methods for as long as it took. Thus, the pressures she felt to deal with the rest of the group and to move on caused her to do a poor job of teaching these students, despite her decision to stick with the original plan to teach the material to the whole class.

The fourth type of critical moment was the mildest in terms of teacher discomfort, and occurred when the teacher realized that she was teaching something that did not need to be taught. Typically, the activities involved were repititions of work covered earlier with only minor variations in materials or questioning patterns. They had been planned with the expectation that students needed more work or opportunity to review, but student response indicated that this was not the case.

These critical moments presented problems to the teachers because time and effort had gone into planning the activities and materials, and because they were scheduled to fill a certain time block that would be unfilled if they were simply abandoned. As the activities progressed, the teacher gradually became more and more aware of and uneasy about the fact that the students were having few if any difficulties, and in fact that they seemed to already know how to do the task. This was indicated not only by a high level of success, but by a relative absence of anything that required real attention and could not be handled with routines. Thus, there was little evidence that the students were thinking about or discovering anything about the material, in addition to little evidence of any confusion. The teacher's negative affect involved displeasure at the thought of wasting students' time, and also fear that students might become bored.

This was not sufficient to make her abandon the activity, however, and she later even rationalized it on the grounds that students need lots of practice and also get feelings of satisfaction from experiencing success. Again, Shroyer saw this as post facto rationalization, believing that the teacher would not have taught the activity had she foreseen that students did not really need it, but felt compelled to continue with it because planning and preparation had gone into it and because alternative activities had not been planned or prepared.

Shroyer's work and other studies reviewed in this section indicate that teachers often do not closely monitor their own behavior during interactive teaching, and that even when they do become aware of problems, they often are unable to solve them at the time and thus must postpone taking remedial action. These studies do not provide much support for the notion that teachers are proactive decision makers and problem solvers during instruction, and there even is considerable support for the notion that interactive teaching is mostly conditioned behavior and reactions to immediate situations. However, two recent studies of interactive thinking and decision making suggest a more impressive picture of teachers' mental life during these times.

Some Studies Indicate Impressive Teacher Thinking

Marland (Note 26) used stimulated recall techniques to study the interactive thoughts of two first-grade and two third-grade teachers during language arts and mathematics lessons, and two sixth-grade teachers during language arts lessons. He classified teachers' thoughts not only according to their content but to their functions, the most common of which concerned correcting or adjusting the lesson when it was not going smoothly, dealing with parts of the lesson that are unpredictable in principle (deciding how to respond to a student who gives a partially correct answer), regulating one's own behavior by reference to teaching

principles, and adapting instruction to individual students. Other functions that were logically possible but did not appear often in teachers' thoughts were self-monitoring, verifying interpretations of student behavior, considering alternative teaching tactics, and optimizing instruction. Like the teachers studied by Morine-Dershimer (Note 7), Marland's teachers did not directly consider their teaching style or its effectiveness or impact on students, but instead operated on the basis of hunches or intuitions about how students were responding. Impressions about students were taken as fact rather than as hypotheses to be tested. Although tactical moves were considered (whether or not to make them, or to make them at this time), alternative tactics were not. Thoughts about improving instruction usually did not appear unless the lesson was going poorly.

In addition to providing these descriptive findings, Marland analyzed the teachers' behaviors and rationales in order to induce several explanatory principles. Five such principles or implicit theories were mentioned by at least two of the six teachers and seemed to influence their behavior: compensation, strategic leniency, power sharing, progressive checking, and suppressing emotions.

The principle of compensation involved attempts to compensate for the limited initiation and participation of students who were shy, introverted, limited in ability, or culturally disadvantaged. Teachers referred to this principle when explaining why they went out of their way to call on, encourage, create success experiences for, or otherwise favor children that they saw as needing this kind of help. Strategic leniency was a variation of the compensation principle, involving teachers' tendencies to ignore or respond less sharply to inappropriate classroom conduct by children seen as needing special attention.

The principle of power sharing referred to the sharing of classroom leadership responsibility and authority with students. Teachers referred to this principle not only when discussing their beliefs in the importance of student involvement in classroom decision making, but also in explaining how and why they gave special attention to the students they perceived as class leaders. In particular, they tried to reinforce desirable behavior by these students in the hope that they would be a positive influence on the rest of the class. The principle of progressive checking was invoked by teachers who explained why they made it a point to periodically check on the progress of certain students, particularly low ability students during independent work times. These students were seen as needing more structure, more assistance, and more encouragement, and frequent, systematic checking was seen as a way to meet these needs.

The last principle, suppressing emotions, was mentioned by teachers who explained why they consciously suppressed their emotional reactions while teaching. One reason for this was that teachers were conscious of their roles as models, and feared that too much emotional expression on their part might lead to unacceptable emotionality among the students. In addition, teachers felt obligated to treat all of their students professionally, courteously, and equally. Consequently, they made conscious efforts to mask their emotional reactions when they became aware that they particularly liked or disliked certain students.

Connors (Note 27) replicated and extended Marland's work (both studies were dissertations done at the University of Alberta in Canada). The descriptive findings from this study replicate those of others: Most interactive thoughts are about pupils and activities, not objectives. Moreover, pupil response and level

of participation are the cues that teachers use most often to judge the success of lessons. Like Marland, Connors draws inductive inferences from teachers' behavior and rationales in order to identify principles that guide their behavior and the beliefs that support these principles. Principles were classified into overarching principles, general pedagogical principles, and more specific principles from learning theory, motivational theory, and human growth and development. Three overarching principles were used by all nine of the teachers in the study: teacher authenticity, suppressing emotions, and self-monitoring.

The principle of teacher authenticity involved the teachers' presenting themselves to students as ordinary adults who do not know everything and who make mistakes. This principle is involved in building good relationships with students and promoting a relaxed classroom atmosphere.

The principle of suppressing emotions was the same one described by Marland. The principle was invoked to protect pupil self concept by avoiding harsh chastisement, and also used as a management strategy when teachers deliberately maintained controlled silence in order to gain attention of the class. Connors notes that teachers did not always adhere to this principle. Sometimes they could not contain their emotions, and occasionally they deliberately violated the principle in order to use a display of emotion as the ultimate management strategy.

The principle of self-monitoring indicates that teachers were more or less continuously aware of their own behavior and were assessing it critically (even though they could not be certain of how the pupils perceived this behavior). This principle is but one of several aspects of Connors' findings illustrating the greater degree of self awareness and reality contact seen in his teachers than has been reported by other investigators. In addition to these overarching principles, Connors identified five general pedagogical principles. Three of these

(cognitive linking, integration, and general involvement) were used by all teachers, and two others (equality of treatment and closure) were used less frequently.

The principle of cognitive linking involved teacher recognition that new knowledge should be related to information that pupils already possess. It was seen as especially relevant during introductions to lessons and reviews. The principle of integration involved teacher recognition that transfer of training can be facilitated by crossing subject area boundaries in order to enable students to practice skills and concepts learned in one subject area when they are involved in activities in another subject area. The principle of general involvement referred to teacher attempts to involve all pupils in lessons and even use the lessons to develop aspects of their personalities when the teachers believed that this was desirable. This principle was especially relevant to the teachers' attempts to draw shy students into discussions and lessons.

The principle of equality of treatment involved attempts to consistently treat all pupils as equals. The principle of closure involved teacher recognition of the importance of reviewing, summarizing, and evaluating key points. It was especially relevant to teacher behavior at the close of lessons.

In addition to the principles already described, Connors identified principles of learning theory, motivation theory, and human growth and development that teachers frequently invoked. Learning theory principles included repetition, reinforcement, motivation, pupil feedback, active pupil involvement in the learning process, and transfer of learning. Other teacher thoughts connected with learning were organized around major learning processes: problem solving, association and discrimination, and the importance of using a variety of modes of presentation. There also were various motivational principles dealing with

maintaining or enhancing student self-concept, creating a good classroom atmosphere, and catering to individual differences. Finally, various teacher thoughts were related to developmental principles or stages of development.

After discussing the principles themselves, Connors discusses the teachers' beliefs that provide rationales for the principles. These include beliefs about learning, motivation, and development, as well as teacher-role conceptions and associated beliefs about appropriate classroom rules.

There are other facets to Connors' analysis as well, which will not be reviewed here. I think it is important, however, to make two general points about this study. First, along with the earlier study by Marland, it illustrates the value of going beyond descriptions of teachers' thinking and behavior in order to induce the general principles that seem to be guiding them. Second, this study provides striking examples of the richness and variety of teachers' perceptions, thinking, and decision making during interactive instruction. This suggests that the methods and lines of inquiry followed by Connors may be worth pursuing in other investigations. In particular, this line of work might establish that teachers are more aware, observant, and rational during instruction than most observers, including myself, have supposed.

Consider these examples provided by Connors. Two teachers varied the difficulty level of questions in order to involve certain pupils in the discussion without embarrassing them. Another knew which pupils she could rely on to keep answering questions, so she often delayed asking these pupils questions in order to concentrate on non-volunteers and those who infrequently contributed to discussions. All teachers knew which pupils did not contribute to discussions because of shyness or other reasons and made efforts to involve them. They also were aware of pupils who tended to dominate discussions and made efforts to

minimize their influence (often by ignoring some of their comments and questions). When teachers knew that the lesson had to move along at a good pace, they would call on pupils that they knew could give correct answers. Teachers' reactions to inappropriate conduct varied according to their knowledge of the likelihood that the student would become disruptive and of how the student would respond to soft versus sharp reprimands. Teachers were usually aware of pupil movement in the class such as walking around the room or raising hands to seek attention. They also monitored students' facial expressions, and sometimes used this information in deciding when to end an activity.

Despite the fact that these observations and actions took place regularly, observers typically would not be aware of them unless they probed the teachers' thinking later through stimulated recall and related techniques. In general, Connors reports more teacher self-awareness and reflection and more correspondence between beliefs and behavior than most other investigators. It will be important to determine the reasons for these discrepancies, and to establish whether the differences in findings are real or simply a difference in how the investigators interpret their data. In any case, the emphasis on asking teachers why they do what they do and on inducing the general principles that guide their thinking and behavior seems worth retaining in future research.

This Research Has the Potential to Improve Practice

As someone interested not merely in teachers' thinking but in teachers' behavior and its outcomes, I am especially impressed with the potential of research on teachers' interactive thinking and decision making to contribute to the improvement of teacher education and teaching practice. Such studies are a particularly fertile source of hypotheses about effective teaching, particularly issues of individualization of instruction during interactive teaching and optimizing

of responses to the kinds of student behavior that Clark and Yinger referred to as "unpredictable in principle." Before this can be accomplished, of course, there will have to be attention to quality, and not just description. Thus, many of my earlier comments about research on teacher planning apply to research on interactive thinking and decision making as well.

I believe that the induction of general principles done by Marland and by Connors is a very useful exercise. No doubt many of the principles that will be derived from such analyses will simply be replications and applications to educational settings of the principles already catalogued by Heider and other students of naive psychology. Many others will probably go considerably beyond this, however. Like research on teacher planning, research on the principles that guide teachers' decision making should prove particularly fruitful for illuminating the specific expertise that teachers possess.

As a final comment, I would like to stress the need for being more selective in recruiting teachers to study, more informative in describing their backgrounds and characteristics, and more diligent in assessing and reporting their levels of effectiveness. Although it may be true that the planning, thinking, and decision making of all teachers are equally interesting and valid as subjects of scientific study, I maintain that information from and about certain teachers is of much more value than that from and about other teachers. In particular, as someone interested in identifying successful teaching practices (not merely in describing the variation that exists), I advocate studying teachers who are both experienced (a minimum of three years) and effective (according to objective criteria).

Other Studies

Before closing, I want to mention two additional lines of research being conducted at the Institute for Research on Teaching. Both concern thinking as it relates

to educational practice, but neither fits cleanly into the categories used in organizing the paper.

Teachers' Conceptions of Reading

The first is a series by Duffy and his colleagues (Bawden, Buike, & Duffy Note 28) on teachers' conceptions of reading. These investigators used questionnaires and interviews with elementary school teachers to determine their conceptions of the reading process, how pupils learn to read, and how reading instruction should be conducted. Their research indicates that teachers do have conceptions of reading, although often more than one and not always without contradictions. Yet, their instructional behavior is usually congruent with their conceptions (this was true for 19 of 23 teachers interviewed).

Conceptions of reading vary in complexity and stability, and differ by grade level. For example, seven of eight first-grade teachers stressed content (the other was eclectic), but most teachers at higher grade levels had more pupil-oriented conceptions. The content-oriented teachers stressed basal texts and linear skills, and the pupil-oriented teachers stressed natural language, the importance of pupil interest, and the use of integrated curriculum models. The more experienced teachers tended to be content oriented. This could have been a cohort effect (a natural language approach has been stressed in teacher training in recent years, but the linear skills approach was much more dominant previously). However, Bawden, Buike, and Duffy report that changes in teachers' conceptions of reading over time are based on experience and not on exposure to reading methods courses.

Even though they possess conceptions of reading, teachers often explain their behavior during reading lessons by referring to non-reading concepts: Classroom management and routines, maintaining good teacher-student relationships, responding to the individual needs of students, and so on. Thus, reading conceptions are just one set of a great many influences on reading instruction, and not always the most important set. The idea that beginning readers need structure

and a focus on content is widely shared among teachers at all levels studied, but beyond this, conceptions of reading vary considerably. The authors have not yet reported data on the issue, but they state their belief that teachers with more elaborate or clear (to them) conceptions of reading are not necessarily more successful reading instructors than other teachers.

Those interested in teachers' conceptions of mathematics might profit from studying the work of Bawden, Buike & Duffy on conceptions of reading.

Studies of Clinical Diagnosis

The second line of research I want to mention has been conducted by Vinsonhaler (Note 22), Weinshank (Note 29) and others. This work involves studying the thinking, decision making, and behavior of experts in reading and learning disabilities as they attempt to perform clinical diagnosis of students' learning problems. In most of this work, the subjects are working with simulated cases rather than real students, and are merely performing diagnoses rather than attempting to teach. Even so, the work would seem to have important implications for problem solving and remediation in the classroom.

The simulated cases are developed from data on real students who have the kinds of problems that typically are presented to educational diagnosticians (some combination of learning and adjustment problems, typically featuring one or more learning disabilities). Material on the student is assembled in a file containing background information, test data (both the usual standardized tests and an array of special diagnostic tests), report cards, data from interviews with teachers and parents, and other information. For the research, the diagnosticians are allowed to have any or all of this information in whatever order they wish, and can use the information in any way that they like. The diagnosticians

used as subjects typically are highly regarded and well trained professionals who teach in this field at the university and/or practice in school systems. All are experienced and come highly recommended. Furthermore, the information available as they sift through simulated cases is usually more than is available to them in their work settings. Consequently, there is every reason to believe that diagnosis of the simulated cases constitutes a realistic and fair opportunity for them to exercise their skills.

Nevertheless, the results are discouraging. Reliability analyses reveal that each diagnostician has a predictable and reliable pattern (selects about the same number and kinds of cues or items of information to use in arriving at a diagnosis, inspects these items in the same general sequences, takes about the same amount of time to arrive at a diagnosis, and so on). However, this standard procedure does not yield reliable diagnoses. Correlations of diagnoses of alternate versions of the same case (with a different name and with inconsequential changes in details) typically are not even statistically significant. Thus, these expert clinicians are not even reliable with themselves, let alone with one another, in agreeing on diagnoses (Vinsonhaler, Note 22).

Weinshank (Note 29) provides some insight into why this is so. She analyzed the cues used as a basis for arriving at diagnoses, the diagnoses themselves, and the recommended remedial strategies. Essentially, these three aspects of the diagnostic process had no clear relationships to one another. Patterns of cue selection and use tended to be a matter of individual style, as noted above. Yet, even when the same diagnostician used the same kinds of cues in the same general way, the probabilities were not much better than chance that he or she would arrive at the same diagnosis on an equivalent case.

In view of this unreliability, it is not surprising that diagnoses did not show clear relationships with recommended remediation strategies. Even so, Weinshank showed that they probably would not have done so even if they were reliable, because most of the clinicians made the same kinds of remediation suggestions more or less regardless of the specifics of the case. That is, a small set of remediation suggestions was repeated regularly, and there was little evidence of specific remediation strategies linked to specific diagnostic conclusions.

I have inspected this research carefully and have satisfied myself that the findings and interpretations are accurate. That is, I consider diagnosis as it presently is practiced by reading and learning disability specialists to be unreliable. The field lacks a sufficiently specific and validated knowledge base to support genuine diagnostic activity. In medical diagnosis (at least for well recognized and documented disorders) a specific pattern of symptoms is differentiated from similar but not identical patterns and traced to a specific cause which implies specific treatment. Educational diagnosis (and psychological diagnosis, for that matter) is much more primitive. Indicators tend to be normative rather than specific and truly diagnostic, and treatments tend to be limited to one or a small number of general approaches. In educational diagnosis and remediation, it is as if we are treating all patients by telling them to get some rest, take aspirin, and drink a lot of liquids, no matter what their problem. I will not carry this discussion further except to note that I presently see no reason to believe that the state of diagnosis and remediation of problems in mathematical learning is any more advanced than in reading or learning disabilities. Until we develop a knowledge base to support more truly diagnostic and remedial procedures, I do not think that we can expect much from even experts, let alone ordinary classroom teachers.

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